

### SUPPORT FOR THE AMENDMENT

This Amendment cancels Claims 11-13, 17 and 23-24; amends Claims 5 and 7-9; and adds new Claims 31-35. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claims 5 and 7-8 is found in canceled Claims 11-13 and in the specification at least at page 2, [0005] ("the total amount of iron and manganese is 3.0% by mass or greater") and at Table 1, No. 1 ("3" wt% Ni). Support for new Claim 31 is found in the specification at Table 1, No. 1 ("0.4" wt% Ti). Support for new Claims 32-33 is found in the specification at least at Table 1, No. 6 ("2" wt% Mn). Support for new Claims 34-35 is found in the specification at least at Table 1, No. 16 ("2.5" wt% Fe + "1.2" wt% Mn = 3.7 wt% Fe and Mn). No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 5, 7-9, 14, 18, 21-22 and 25-35 will be pending in this application. Claims 5, 7, 8 and 9 are independent.

### REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention provides an aluminum alloy for casting members for which high rigidity and a low linear thermal expansion coefficient are required, such as ladder frames and cases for automobiles. Specification at [0001].

Claims 5, 7-8, 21, 23-25 and 27-29 are rejected under 35 U.S.C. 103(a) over U.S. Patent No. 5,066,323 ("Mulder"). Mulder discloses an aluminum alloy containing up to 1% Mn. Mulder at column 2, lines 23-24. However, Mulder fails to suggest the limitation of independent Claims 5 and 7-8 of "1.2-3% by mass of manganese". Manganese improves

rigidity and reduces the linear expansion coefficient. Specification at [0012]. Thus, the rejection over Mulder should be withdrawn.

Claims 9, 22, 26 and 30 are rejected under 35 U.S.C. 103(a) over Mulder in view of ASM Handbook Volume 2, page 55, columns 2-3 ("ASM").

Mulder relates to hexafluorophosphates, preferably alkali metal hexafluorophosphates, for use as structure refiners during the solidification of molten aluminum-silicon alloys. Mulder at column 2, lines 5-9. Mulder discloses that the hexafluorophosphates are preferably used in the form of a master composition that is added to the molten aluminum-silicon alloy. Mulder at column 2, lines 28-33. Mulder discloses that titanium can be used as a diluent in the master composition. Mulder at column 2, lines 58-61.

However, Mulder is silent about an amount of titanium in Mulder's aluminum-silicon alloy, and fails to suggest the independent Claim 9 limitation of "one or more of 0.01-1.0% by mass of titanium, 0.0001-1.0% by mass of boron, 0.1-1.0% by mass of zirconium, 0.1-1.0% by mass of vanadium, and 0.01-1.0% by mass of molybdenum".

ASM fails to remedy the deficiencies of Mulder. ASM discloses that amounts of 10 to 100 ppm (= 0.001 to 0.01 wt%) Ti are found in commercial-purity aluminum and that Ti is used primarily as a grain refiner of aluminum alloy castings and ingots. ASM at page 55, columns 2-3.

The Office Action asserts:

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add 10 ppm to 100 ppm (0.001 to 0.01 weight percent titanium) with boron in the form of soluble  $TiB_2$ , as disclosed by the ASM Handbook Volume 2, to the aluminum alloy, as disclosed by Mulder ('323), in order to provide an **enhanced grain refining effect**, as disclosed by the ASM Handbook Volume 2 (page 55, cols. 2-3). Office Action at page 9, lines 17-22 (emphasis added).

Where does the prior art say that Ti enhances the grain refining effect of Mulder's hexafluorophosphates in Mulder's aluminum-silicon alloy? ASM is silent about the use of Ti in aluminum-silicon alloy. The cited prior art is silent about any combined grain refining effect of Ti and hexafluorophosphates.

Where is the motivation to combine ASM's Ti with Mulder's aluminum-silicon alloy to enhance grain refining? Mulder's invention is directed to the use of hexafluorophosphates as a grain refiner. If enhanced grain refining is desired, the skilled artisan would be motivated to use Mulder's hexafluorophosphates in Mulder's aluminum-silicon alloy. There is no reasonable expectation that the skilled artisan would have combined ASM with Mulder to reach "0.01-1.0% by mass of titanium" in Mulder's aluminum-silicon alloy.

Because there is no motivation to combine ASM with Mulder, and no reasonable expectation of such a combination, Mulder in view of ASM fails to suggest the independent Claim 9 limitation of "one or more of 0.01-1.0% by mass of titanium, 0.0001-1.0% by mass of boron, 0.1-1.0% by mass or zirconium, 0.1-1.0% by mass of vanadium, and 0.01-1.0% by mass of molybdenum". This range of composition results in an improved combination of high rigidity (Young's modulus of 90 GPa or more) and low linear thermal expansion coefficient ( $18 \times 10^{-6}/^{\circ}\text{C}$ ).

Thus, the rejection over Mulder in view of ASM should be withdrawn.

Claims 5, 7-9, 11-14, 17-18 and 21-30 are rejected under 35 U.S.C. 103(a) over U.S. Patent No. 3,325,279 ("Lawrence"). Lawrence discloses an aluminum alloy containing from **26 to 45 percent by weight of silicon**. Lawrence at column 1, lines 47-48.

However, Lawrence fails to suggest the limitation of independent Claims 5 and 7-8 of "**13-25% by mass of silicon**, 2-8% by mass of copper, 0.5-3% by mass of iron, 1.2- 3 % by mass of manganese, 1-3% by mass of

nickel, 0.001-0.02% by mass of phosphorus, and the remainder, which consists of aluminum and inevitable impurities" and

the limitation of independent Claim 9 of "**13-25% by mass of silicon**; 2-8% by mass of copper; 0.5-3% by mass of iron; 1- 3 % by mass of manganese; 0.5-6% by mass of nickel; 0.001-0.02% by mass of phosphorus; 0.1-1.0% by mass of chromium; one or more of 0.01-1.0% by mass of titanium, 0.0001-1.0% by mass of boron, 0.1-1.0% by mass or zirconium, 0.1-1.0% by mass of vanadium, and 0.01-1.0% by mass of molybdenum; and the remainder, which consists of aluminum and inevitable impurities". At greater than 25 mass% Si, primary silicon becomes coarse and the rigidity improving effect of Si is reduced.

Specification at page 3, lines 1-5.

Thus, the rejection over Lawrence should be withdrawn.

Claims 5, 7, 11-12, 23-24 and 27-28 are rejected under 35 U.S.C. 103(a) over JP 03-199336 ("Kami"). Kami discloses an aluminum alloy containing 0.2 to 1.5% by weight of Mn and 1.5% by weight of less of Fe. English-language translation of Kami at page 5, lines 3-10. Kami discloses that castability and toughness are impaired when the content of Mn exceeds 1.5% by weight. English-language translation of Kami at page 7, line 16-18. In addition, Kami discloses that it is necessary to limit the content of Fe to 1.5% [sic] by weight or less to avoid pronounced loss of ductility and hard spots. English-language translation of Kami at page 8, lines 4-7. However, Kami teaches away from the limitation of independent Claims 5 and 7 that "the total amount of iron and manganese is 3.0% by mass or greater", in order to prevent castability, toughness and ductility from being impaired. Kami fails to suggest the reduction in linear expansion coefficient to " $18 \times 10^{-6}/^{\circ}\text{C}$  or less" that is achieved by the present invention when "the total amount of iron and manganese is 3.0% by mass or greater". Specification at [0012].

Thus, the rejection over Kami should be withdrawn.

New Claim 31-35 are further patentably distinguishable over the cited prior art. The cited prior art fails to suggest the new Claim 31 limitation that "titanium is in the aluminum alloy in an amount in a range of from 0.4-1.0% by mass"; the limitation of new Claims 32-33 that "the amount of manganese is 2-3% by mass"; and the limitation of new Claims 34-35 that "the total amount of iron and manganese is 3.7% by mass or greater".

Applicants respectfully request that the Examiner acknowledge receipt of a certified copy of the priority document by initialing the appropriate boxes under section 12 on a Form PTOL-326.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

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